Peering and IXPs

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Presentation Slides

- Available on
  - http://bgp4all.com.au/ftp/seminars/ PacNOG16-Peering-IXPs.pdf
  - And on the PacNOG16 website
- Feel free to ask questions any time

The Internet

- Internet is made up of Network Operators of all shapes and sizes
  - Some have local coverage (access providers)
  - Others can provide regional or per country coverage
  - And others are global in scale
- These Operators interconnect their businesses
  - They don't interconnect with every other ISP (over 48000 distinct autonomous networks) – won't scale
  - They interconnect according to practical and business needs
- Some ISPs provide transit to others
  - They interconnect other ISP networks
  - Over 6000 autonomous networks provide transit

Categorising ISPs
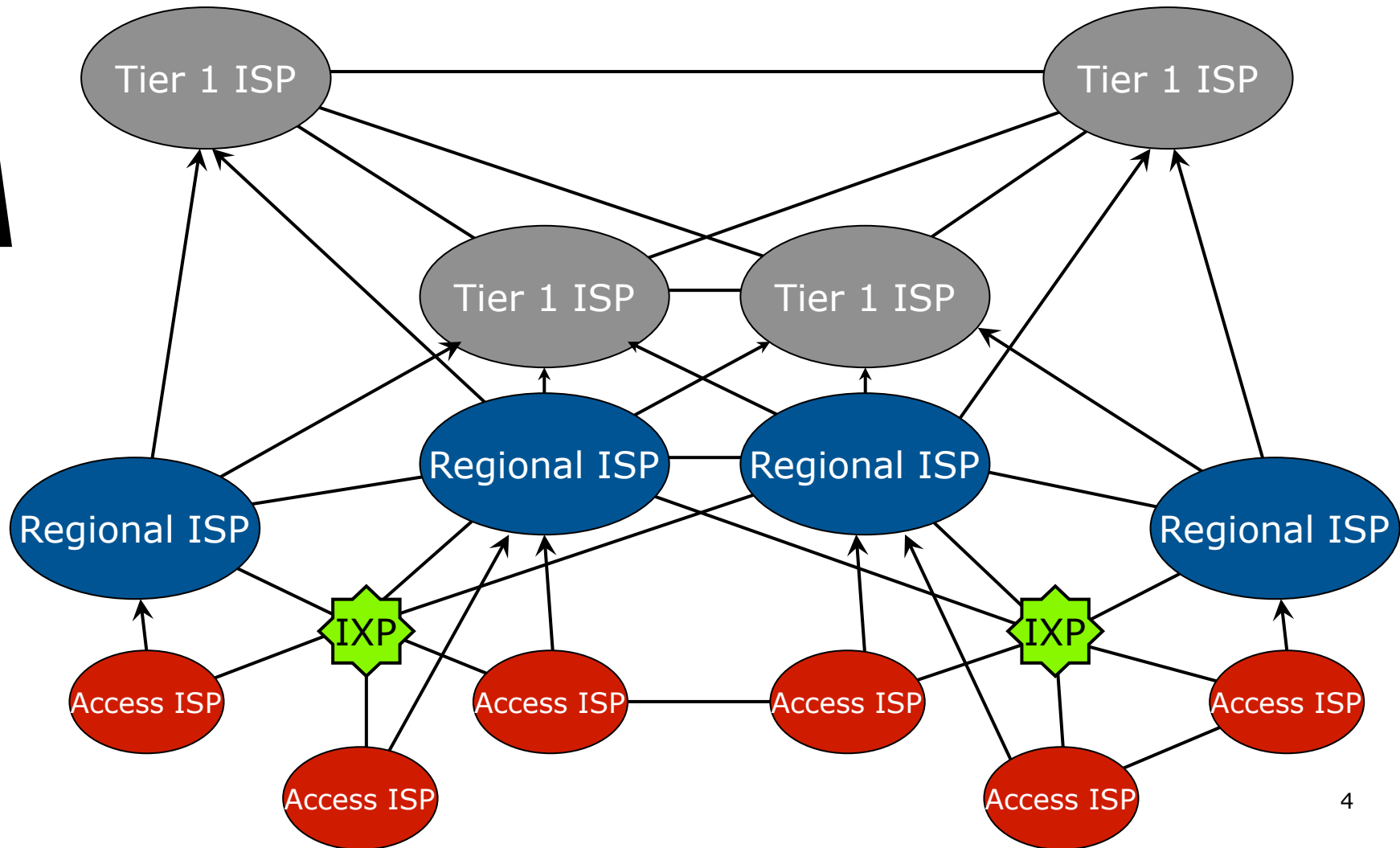
Peering and Transit

- Transit
  - Carrying traffic across a network
  - Usually for a fee
  - Example: Access provider connects to a regional provider
- Peering
  - Exchanging routing information and traffic
  - Usually for no fee
  - Sometimes called settlement free peering
 - Example: Regional provider connects to another regional provider

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Private Interconnect

- Two ISPs connect their networks over a private link
  - Can be peering arrangement
    - No charge for traffic
    - Share cost of the link
  - Can be transit arrangement
    - One ISP charges the other for traffic
    - One ISP (the customer) pays for the link
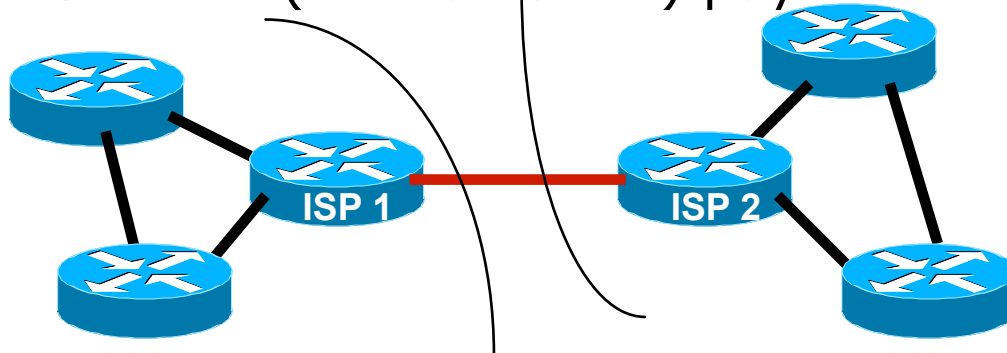
Public Interconnect

- Several ISPs meeting in a common neutral location and interconnect their networks
  - Usually is a peering arrangement between their networks
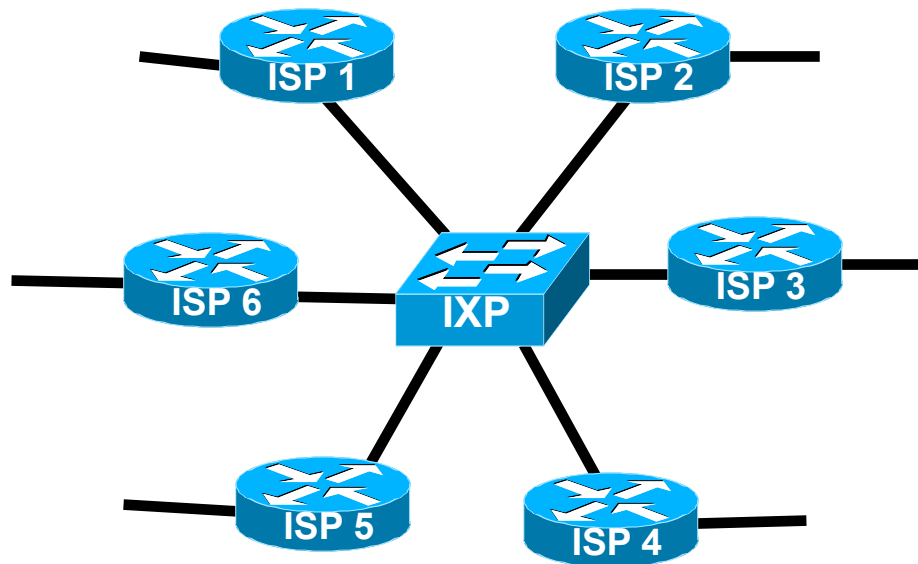
Types of Peering (1)

- Private Peering
  - Where two network operators agree to interconnect their networks, and exchange their respective routes, for the purpose of ensuring their customers can reach each other directly over the peering link
- Settlement Free Peering
  - No traffic charges
  - **The most common form of peering**
- Paid Peering
  - Where two operators agree to exchange traffic charges for a peering relationship

Types of Peering (2)

- Bi-lateral Peering
  - Very similar to Private Peering, but may take place at a public peering point (IXP)
- Multilateral Peering
  - Takes place at Internet Exchange Points, where operators all peer with each other via a Router Server
- Mandatory Multilateral Peering
  - Where operators are forced to peer with each other as condition of IXP membership
  - Strongly discouraged: Has no record of success

Types of Peering (3)

- Open Peering
  - Where an ISP publicly states that they will peer with all parties who approach them for peering
  - Commonly found at IXPs where ISP participates via the Route Server
- Selective Peering
  - Where an ISP's peering policy depends on the nature of the operator who requests peering with them
  - At IXPs, operator will not peer with RS but will only peer bilaterally
- Closed Peering
  - Where an ISP decides who its peering partners are, and is generally not approachable to creating peering opportunities

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Types of Peering (4)

- The Peering Database documents ISPs peering policies
  - http://peeringdb.com
- All operators of ASNs should register in the peeringdb
  - All operators who are considering peering or are peering must be in the peeringdb to enhance their peering opportunities
- Participation in peering fora is encouraged too
  - Global Peering Forum (GPF)
  - Regional Peering Fora (European, Middle Eastern, Asian, Caribbean, Latin American)

ISP Goals

- Minimise the cost of operating the business
- Transit
  - ISP has to pay for circuit (international or domestic)
  - ISP has to pay for data (usually per Mbps)
  - Repeat for each transit provider
  - Significant cost of being a service provider
- Peering
  - ISP shares circuit cost with peer (private) or runs circuit to public peering point (one off cost)
  - No need to pay for data
  - Reduces transit data volume, therefore reducing cost

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Transit – How it works

- Small access provider provides Internet access for a city's population
  - Mixture of dial-up, wireless and fixed broadband
  - Possibly some business customers
  - Possibly also some Internet cafes
- How do their customers get access to the rest of the Internet?
- ISP buys access from one, two or more larger ISPs who already have visibility of the rest of the Internet
  - This is transit – they pay for the physical connection to the upstream and for the traffic volume on the link

Peering – How it works

- If two ISPs are of equivalent sizes, they have:
  - Equivalent network infrastructure coverage
  - Equivalent customer size
  - Similar content volumes to be shared with the Internet
  - Potentially similar traffic flows to each other's networks
- This makes them good peering partners
- If they don't peer
  - They both have to pay an upstream provider for access to each other's network/customers/content
  - Upstream benefits from this arrangement, the two ISPs both have to fund the transit costs

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The IXP's role

- Private peering makes sense when there are very few equivalent players
  - Connecting to one other ISP costs X
  - Connecting to two other ISPs costs 2 times X
  - Connecting to three other ISPs costs 3 times X
  - Etc... (where X is half the circuit cost plus a port cost)
- The more private peers, the greater the cost
- IXP is a more scalable solution to this problem

The IXP's role

- Connecting to an IXP
  - ISP costs: one router port, one circuit, and one router to locate at the IXP

- Some IXPs charge annual "maintenance fees"
  - The maintenance fee has potential to significantly influence the cost balance for an ISP

- Generally connecting to an IXP and peering there becomes cost effective when there are at least three other peers
  - The real $ amount varies from region to region, IXP to IXP

Internet Exchange Point

- What:
  - **A neutral location where network operators freely interconnect their networks to exchange traffic**
- What is the physical IX:
  - An ethernet switch in a neutral location
- How does it work:
  - IX Operator provides the switch and rack space
  - Network Operators bring routers, and interconnect them via the IX fabric
- Very simple concept – any place where providers meet to exchange traffic

Who peers at an IXP?

- **Access Providers**
  - Don't have to pay their regional provider transit fees for local traffic
  - Keeps latency and costs for local traffic low
  - 'Unlimited' bandwidth through the IXP (compared with costly and limited bandwidth through transit provider)

- **Regional Providers**
  - Don't have to pay their global provider transit for local and regional traffic
  - Keeps latency and costs for local and regional traffic low
  - 'Unlimited' bandwidth through the IXP (compared with costly and limited bandwidth through global provider)

Internet Exchange Point

- Solution
  - Every ISP participates in the IXP
  - Cost is minimal – one local circuit covers all domestic traffic
  - International circuits are used for just international traffic – and backing up domestic links in case the IXP fails
- Result:
  - **Local traffic stays local**
  - **No QoS considerations for local traffic**
  - RTTs are typically sub 10ms
  - Customers enjoy the Internet experience
  - Local Internet economy grows rapidly

The IXP's role

- Global Providers can be located close to IXPs
  - Attracted by the potential transit business available
- Advantageous for access & regional providers
  - They can peer with other similar providers at the IXP
  - And in the same facility pay for transit to their regional or global provider
  - (Not across the IXP fabric, but a separate connection)

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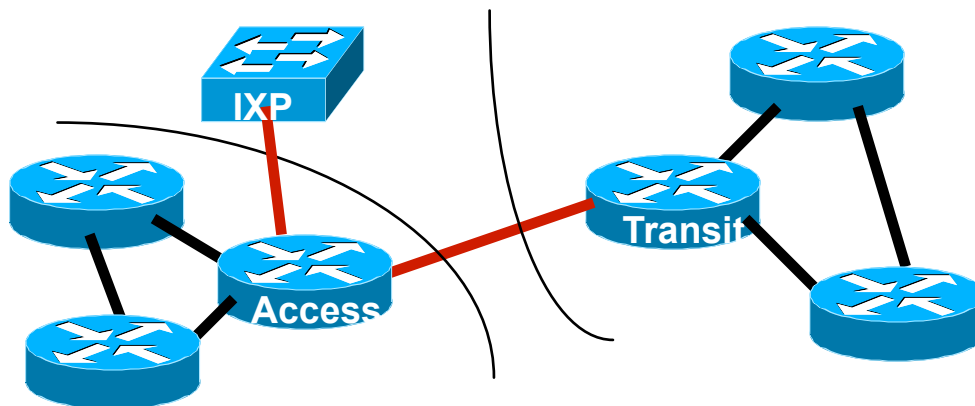
Who can join an IXP?

- Requirements are very simple: any organisation which operates their own autonomous network, and has:
  - Their own address space
  - Their own AS number
  - Their own transit arrangements
- This often includes:
  - Commercial ISPs
  - Academic & Research networks
  - Internet infrastructure operators (eg Root/ccTLDs)
  - Content providers
  - Broadcasters and media
  - Government Information networks

Connectivity Decisions

- Transit
  - Almost every ISP needs transit to reach rest of Internet
  - One provider = no redundancy
  - Two providers: ideal for traffic engineering as well as redundancy
  - Three providers = better redundancy, traffic engineering gets harder
  - More then three = diminishing returns, rapidly escalating costs and complexity
- Peering
  - Means low (or zero) cost access to another network
  - Private or Public Peering (or both)

Peering or Transit?

- How to choose?
- Or do both?
- It comes down to cost of going to an IXP
  - Free peering
  - Paying for transit from an ISP co-located in same facility, or perhaps close by
- Or not going to an IXP and paying for the cost of transit directly to an upstream provider
  - There is no right or wrong answer, someone has to do the arithmetic

Summary

- Benefits of peering
  - Private
  - Internet Exchange Points
  - Keeping Local Traffic Local
  - Improving local QoS
  - Improving local Internet Economy

Peering and IXPs

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